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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/644,957	08/21/2003	Gordon Bease	071469-0305396	7598
909	7590	03/01/2005	EXAMINER	
PILLSBURY WINTHROP, LLP P.O. BOX 10500 MCLEAN, VA 22102			ARANCIBIA, MAUREEN GRAMAGLIA	
			ART UNIT	PAPER NUMBER
			1763	
DATE MAILED: 03/01/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/644,957

Applicant(s)

BEASE ET AL.

Examiner

Maureen G. Arancibia

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) 17-36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-36 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 August 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-16, drawn to a method of processing a layer containing a high-permittivity material in a plasma processing system, classified in class 216, subclass 67.
 - II. Claims 17-36, drawn to a plasma processing system, classified in class 156, subclass 345.43.
2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process, such as etching ceramic.
3. Because these inventions are distinct for the reasons given above and the search required for Group II is not required for Group I, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Jeffrey Karceski on 02/08/2005 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-16. Affirmation of this election must be made by applicant in replying to this

Office action. Claims 17-36 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "708" in Figure 7 has been used to designate both the next to last and the last steps in the flowchart. Paragraph 51 of the Specification identifies the last step by reference character "710." It appears that Figure 7 should be corrected to identify the last step of the flowchart by reference character "710." Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

7. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: Claim 3 recites a method wherein the “modifying partially disassociates the layer containing the high-permittivity material.” There does not appear to be proper antecedent basis for this limitation in the specification.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically, it is unclear what type of process the phrase “partially disassociates” is intended to convey. For the following examination on the merits, the Examiner has interpreted this phrase to mean partial removal. However, clarification and correction are required.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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11. Claims 1-4, 6-10, 15, and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,818,553 to Yu et al.

Yu et al. teaches a method of processing a layer 14 containing a high-permittivity (high-k) material (Column 2, Lines 24-25) overlying a substrate 10, comprising providing said high-k layer (Column 2, Lines 24-25); modifying said high-k layer by exposing it to a plasma (Column 2, Line 63 - Column 3, Line 6); and wet etching to remove the modified high-k layer (Column 3, Lines 45-51).

In regards to Claims 2 and 3, the modification performed by exposure to the plasma partially removes the high-k layer, leaving partially etched layer 14'. (Column 3, Lines 3-5; Figure 4)

In regards to Claim 4, Yu et al. teaches that the processing method comprises creating a plasma from a process gas comprising a reactive (fluorine-based) gas. (Column 3, Lines 33-45)

In regards to Claims 6-9, Yu et al. further teaches that the process gas can comprise an inert gas such as helium or argon. (Column 3, Lines 14-16)

In regards to Claim 10, Yu et al. teaches that the high-permittivity (high-k) material can comprise HfSiO. (Column 2, Line 29)

In regards to Claim 15, see the discussion of Claim 4.

In regards to Claim 16, see the discussion of Claim 4. Yu et al. additionally teaches that the modification performed by exposure to the plasma is anisotropic. (See Figure 4)

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent 6,579,809 to Yang et al.

The teachings of Yu et al. were discussed above.

In regards to Claim 5, Yu et al. does not expressly teach that the process gas can comprise at least one of HBr and HCl.

Yang et al. teaches that a high-k layer 62 (Column 5, Lines 7-9) can be etched with plasma created from a process gas comprising HBr. (Column 7, Lines 20-27)

It would have been obvious to one of ordinary skill in the art to modify the process gas taught by Yu et al. to comprise HBr, as taught by Yang et al. The motivation for doing so, as taught by Yang et al. (Column 7, Lines 22-23), would have been to make the etching conditions selective for the high-k material over the underlying silicon substrate.

14. Claims 11, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent 6,536,449 to Ranft et al.

The teachings of Yu et al. were discussed above.

Yu et al. does not expressly teach that a substrate holder exposing the substrate to the plasma should be RF powered (as recited in Claim 11), grounded (as recited in Claim 12), or electrically isolated (as recited in Claim 14).

Ranft et al. teaches a substrate holder 104 for use in a plasma etching method (Column 5, Lines 4-8) can be grounded (Column 5, Line 40), electrically isolated (Column 5, Lines 50-52), or RF powered (Column 5, Lines 57-58).

It would have been obvious to one of ordinary skill in the art to modify the method taught by Yu et al. to ground the substrate holder (as recited in Claim 12), electrically isolate the substrate holder (as recited in Claim 14), or RF power the substrate holder (as recited in Claim 11). The motivation for grounding the substrate holder, as taught by Ranft et al. (Column 5, Lines 40-50), would have been to etch with higher currents and energies of ion bombardment. The motivation for electrically isolating the substrate holder, as taught by Ranft et al. (Column 5, Lines 50-54), would have been to decrease ion bombardment on the substrate, i.e. to have a gentler etch process. The motivation for supplying RF power to the substrate holder, as taught by Ranft et al. (Column 5, Lines 57-60), would have been to accelerate ions toward the substrate to enhance etching.

15. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent Application Publication 2001/0003271 to Otsuki.

The teachings of Yu et al. were discussed above.

Yu et al. does not expressly teach that a substrate holder exposing the substrate to the plasma should have a DC bias.

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Otsuki teaches that a substrate holder 24 that exposes a substrate W to a plasma (Paragraph 57) can have a DC bias. (Paragraph 48)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Yu et al. to supply the substrate holder with a DC bias, as taught by Otsuki.

The motivation for doing so, as taught by Otsuki (Paragraph 48), would have been to electrostatically attract the substrate to the holder.

Double Patenting

16. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

17. Claims 1-16 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 93 and 95-104 of copending Application No. 10/670,795 ('795) in view of Yu et al., Ranft et al., and Otsuki.

In regards to Claim 1, Claim 93 of '795 recites a method of processing a provided layer containing a high-permittivity material, comprising modifying the layer by exposing it to a plasma, and etching the modified layer in the absence of plasma.

Claim 93 of '795 does not recite that the etching step should be a wet etching, or that the etching step can remove the modified layer.

Yu et al. teaches that a plasma-modified high-permittivity (high-k) layer can be removed by wet etching (Column 3, Lines 45-51).

It would have been obvious to one of ordinary skill in the art to modify the method recited in Claim 93 of '795 to make the etching step a wet etching, and to remove the modified layer during the etching step. The motivation for making the etching step a wet etching, as taught by Yu et al. (Column 3, Line 66 - Column 4, Line 10), would have been to perform a selective etch that does not require masking of the substrate and does not damage other features of the substrate (ex. source/drain areas). The motivation for using the etching step to remove the modified layer, as taught by Yu et al. (Column 3, Lines 52-54) would have been to define a feature (ex. a gate electrode) on the substrate.

In regards to Claim 2, Claim 96 of '795 recites that the modifying step partially removes the high-permittivity layer.

In regards to Claim 3, Claim 97 of '795 recites that the modifying step partially disassociates the high-permittivity layer.

In regards to Claim 4, Claim 95 of '795 recites that the substrate is provided in a process chamber, while Claim 98 of '795 recites that the process gas that creates the plasma comprises a reactive gas.

In regards to Claims 5-9, Claims 99-103 of '795 recite the claimed limitations.

In regards to Claim 10, Claim 104 of '795 recites the claimed limitation.

In regards to Claims 11, 12, and 14, the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 does not expressly teach that a substrate holder exposing the substrate to the plasma should be RF powered (as recited in Claim 11), grounded (as recited in Claim 12), or electrically isolated (as recited in Claim 14).

Ranft et al. teaches a substrate holder 104 for use in a plasma etching method (Column 5, Lines 4-8) can be grounded (Column 5, Line 40), electrically isolated (Column 5, Lines 50-52), or RF powered (Column 5, Lines 57-58).

It would have been obvious to one of ordinary skill in the art to modify the method taught by the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 to ground the substrate holder (as recited in Claim 12), electrically isolate the substrate holder (as recited in Claim 14), or RF power the substrate holder (as recited in Claim 11). The motivation for grounding the substrate holder, as taught by Ranft et al. (Column 5, Lines 40-50), would have been to etch with higher currents and energies of ion bombardment. The motivation for electrically isolating the substrate holder, as taught by Ranft et al. (Column 5, Lines 50-54), would have been to decrease ion bombardment on the substrate, i.e. to have a gentler etch process. The motivation for supplying RF power to the substrate holder, as taught by Ranft et al. (Column 5, Lines 57-60), would have been to accelerate ions toward the substrate to enhance etching.

In regards to Claim 13, the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 does not expressly teach that a substrate holder exposing the substrate to the plasma should have a DC bias.

Otsuki teaches that a substrate holder 24 that exposes a substrate W to a plasma (Paragraph 57) can have a DC bias. (Paragraph 48)

It would have been obvious to one of ordinary skill in the art to modify the method taught by the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 to supply the substrate holder with a DC bias, as taught by Otsuki. The motivation for doing so, as taught by Otsuki (Paragraph 48), would have been to electrostatically attract the substrate to the holder.

In regards to Claim 15, see the discussion of Claims 1 and 4.

In regards to Claim 16, see the discussion of Claims 1 and 4.

The combination of Claims 93 and 95 of '795 and Yu et al. discussed above does not expressly teach that the plasma modification step should proceed anisotropically.

However, Yu et al. further teaches that a plasma modification of a high-permittivity (high-k) layer can take place anisotropically. (See Figure 4)

It would have been obvious to one of ordinary skill in the art to perform the plasma modification step anisotropically, as taught by Yu et al. The motivation for doing so would have been to form smooth vertical sidewalls to define features on the substrate.

This is a provisional obviousness-type double patenting rejection.

Conclusion

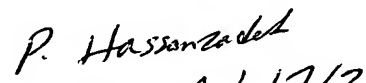
18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 6,806,095 to Nallan et al. teaches that HCl is a suitable process gas for plasma etching high-k materials. (Column 2, Lines 30-36)

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 11-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Maureen G. Arancibia


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